Conservation Assessment
for
Salem Cave Crayfish (Cambarus hubrichti)

(From Pflieger, 1996)

USDA Forest Service, Eastern Region

October 2002

Julian J. Lewis, Ph.D.
J. Lewis & Associates, Biological Consulting
217 W. Carter Avenue
Clarksville, IN 47129
lewisbioconsult@aol.com

This Conservation Assessment was prepared to compile the published and unpublished information on Cambarus hubrichti. It does not represent a management decision by the U.S. Forest Service. Though the best scientific information available was used and subject experts were consulted in preparation of this document, it is expected that new information will arise. In the spirit of continuous learning and adaptive management, if you have information that will assist in conserving the subject community and associated taxa, please contact the Eastern Region of the Forest Service Threatened and Endangered Species Program at 310 Wisconsin Avenue, Milwaukee, Wisconsin 53203.

Table of Contents

EXECUTIVE SUMMARY

The Salem cave crayfish is designated as a Regional Forester Sensitive Species on the Mark Twain National Forest in the Eastern Region of the Forest Service. The purpose of this document is to provide the background information necessary to prepare a Conservation Strategy, which will include management actions to conserve the species.

The Salem cave crayfish is an obligate cavernicole endemic to subterranean habitats in Missouri, where it has been reported from 21 localities.

NOMENCLATURE AND TAXONOMY

Classification: Class Crustacea
Order Decapoda
Family Cambaridae

Scientific name: Cambarus hubrichti

Common name: Salem cave crayfish

Synonyms: none

This species was described by Hobbs (1952) and the taxonomy has remained stable since that time. The description was recapitulated by Hobbs, et al. (1977).

DESCRIPTION OF SPECIES

The Salem cave crayfish is unpigmented with small eyes containing a pigment spot, but lacking facets, and attains a size in excess of 90mm. The pincers are elongated. In life this crayfish is nearly white, with the internal structures visible through the translucent exoskeleton (Pflieger, 1996). Identification of this species with certainty requires a specialist familiar with the taxonomy of crayfish.

LIFE HISTORY

Form I males have been collected in March, June, July and November. A pollution episode in Meramec Spring killing thousands of animals in November, 1977 revealed the presence of at least six females were carrying eggs, and at least two that carrying juveniles. One female had 38 young. The usual life span of crayfish in Missouri is one to three years, although the subterranean species may live considerably longer Pflieger (1996).

HABITAT

Cambarus hubrichti is a troglobite, i.e., an obligate inhabitant of subterranean waters. Pflieger (1996) reported that this species has been found in a wide variety of habitats, including cave streams over rock, sand, mud and bat guano; the edges of deep

subterranean lakes over organic debris; and spring orifices near the limit of daylight at depths of 40-140 feet. Other collection sites included the outflow of a small spring, a pool of water at the bottom of a large sinkhole, and ruts left by a truck that became stuck in a fen.

DISTRIBUTION AND ABUNDANCE

This species is known only from the east-central Ozarks of Missouri, from Cambden and Crawford counties south to Howell and Ripley counties (figure 1). It is present in the Meramec, Gasconade, Osage, Current, Eleven Point and Spring rivers (Pflieger, 1996; Sutton, 1993, in press). New localities reported by Marquart (1979) were largely sight records. Sutton & Hagan (personal communication) have an unpublished record for Cambarus hubrichti from Big Spring, on the Ozark National Scenic Riverways (managed by the National Park Service). A large portion of the Big Spring recharge area is in the Mark Twain National Forest.

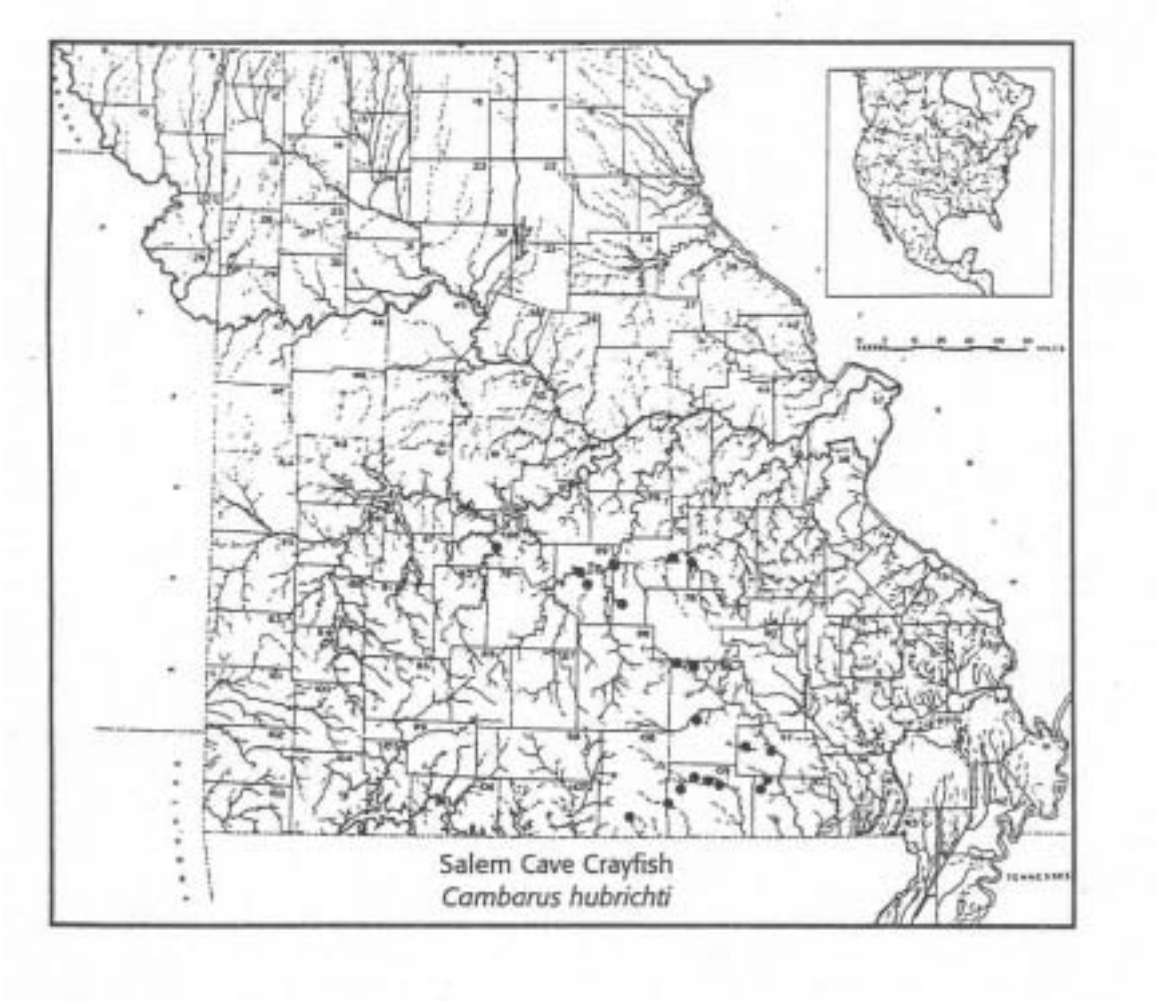

Figure 1. Distribution of the Salem cave crayfish Cambarus hubrichti (from Pflieger, 1996).

RANGEWIDE STATUS

Global Rank: G3 imperiled/vulnerable; The global rank of G3 is indicated for species known from 21-100 sites. Pflieger (1996) reported this species from 20 collection sites, and other unpublished collection sites as well as sight records exist (Sutton, personal communication).

Missouri State Rank: S3 imperiled/vulnerable; The state rank of S3 is assigned for species that are known from 21-100 sites. All of the sites reported by Pflieger (1996) or referenced by Sutton (personal communication) are in Missouri.

POPULATION BIOLOGY AND VIABILITY

Plieger (1996) reported that little was known of the feeding specifics of Cambarus hubrichti or any of the other Missouri crayfish. However, crayfish in general are considered omnivores, feeding on a wide variety of plant and animal material. An indication of the population size of this crayfish was given by a pipeline break of ammonium fertilizer that occurred 13 miles from Meramec Spring in November, 1977. Thousands of Cambarus hubrichti as well as Southern cavefish (Typhlichthys subterraneus) emerged from the spring. Typhlichthys and Cambarus hubrichti were reported together in Dead Man and Trantham caves by Gardner (1986).

POTENTIAL THREATS

No threats to any specific sites inhabited by Cambarus hubrichti were reported by any reviewer of this assessment. However, the November, 1977 fertilizer spill resulting from a broken pipeline killed hundreds of animals including Cambarus hubrichti in the Meramec Spring conduit.

There are numerous potential threats that might reasonably occur on national forest land due to the presence of Caecidotea dimorpha in the restricted cave and groundwater environment. These include problems caused by activities outside of forest owned properties that may be imported by surface runoff or groundwater flow. Potential contaminants include

(1) sewage or fecal contamination, including sewage plant effluent, septic field waste, campground outhouses, feedlots, grazing pastures or any other source of human or animal waste (Harvey and Skeleton,1968; Quinlan and Rowe, 1977, 1978; Lewis, 1993; Panno, et al 1996, 1997, 1998);

(2) pesticides or herbicides used for crops, livestock, trails, roads or other applications; fertilizers used for crops or lawns (Keith and Poulson, 1981; Panno, et al. 1998);

(3) hazardous material introductions via accidental spills or deliberate dumping, including road salting (Quinlan and Rowe, 1977, 1978; Lewis, 1993, 1996).

Habitat alteration due to sedimentation is a pervasive threat potentially caused by logging, road or other construction, trail building, farming, or any other kind of development that disturbs groundcover. Sedimentation potentially changes cave habitat, blocks recharge sites, or alters flow volume and velocity. Keith (1988) reported that pesticides and other harmful compounds like PCB's can adhere to clay and silt particles and be transported via sedimentation.

There is a long history of mineral (e.g., zinc, lead) exploration and development in the southeastern and east central Ozarks and groundwater contamination is a potential threat. Dewatering of karst systems by well drawdown and mine pumping may also be a threat to groundwater species.

With the presence of humans in caves comes an increased risk of vandalism or littering of the habitat, disruption of habitat and trampling of fauna, introduction of microbial flora non-native to the cave or introduction of hazardous materials, e.g., spent carbide, batteries (Peck, 1969; Elliott, 1998). The construction of roads or trails near cave entrances encourages entry.

SUMMARY OF LAND OWNERSHIP AND EXISTING HABITAT PROTECTION

Cambarus hubrichti occurs in the following sites on the Mark Twain National Forest: Oregon County, Cropper Cave, Dead Man Cave, Greer Spring Cave, River Level Cave, Sand Cave; Ripley County, Panther Cave. Posy Cave, also in Oregon Co., lies on private property but is on land covered by a Mark Twain National Forest scenic easement.

Some of the caves on national forest land are protected from human visitation or habitat alteration simply by their physical condition and/or location. Dead Man Cave is along the Eleven Point National Scenic River, but can not be seen from the river itself. No vegetation management occurs in the scenic river corridor, except at developed recreation sites. Dead Man Cave is regularly monitored due to the Gray bat population and evidence of human visitation is light to moderate.

Greer Spring Cave is only accessible after a one mile walk. The spring is heavily visited during the spring through fall seasons, but visitors would have to wade through the 55 degree spring water flowing swiftly from the entrance to get in. No vegetation management occurs in the Greer Spring Special Management Area. However, the majority of the recharge area for Greer Spring Cave is private land outside the boundary of the Mark Twain National Forest.

SUMMARY OF MANAGEMENT AND CONSERVATION ACTIVITIES

No species specific management or conservation activities are being conducted concerning Cambarus hubrichti.

Caves and springs located on the Mark Twain National Forest are subject to Forest Plan standards and guidelines for cave and spring protection and management. Perennial springs and spring branches will have a minimum 100 foot buffer zone within which any treatment will be modified on a case-by-case basis to: (1) meet state water quality standards and regulations, (2) comply with the riparian zone standards and guidelines identified under forest-wide 2500 (water and soil resource management) and 2600 (wildlife habitat management), (3) protect visual aspects, and (4) protect and enhance natural plant and animal communities. Similar guidelines exist for the management of seeps and fens.

Caves in the Mark Twain National Forest are recognized as specialized habitat areas and will be managed in accordance to the recommendations established by Gardner in 1982 in "An Inventory and Evaluation of Cave Resources of the Mark Twain National Forest". This includes the designation of an area of at least five acres centered on and completely surrounding a cave entrance for permanent old growth management. Insecticides and herbicides will not be used within the surface and known subsurface watersheds of caves utilized by the Indiana or Gray bats, Ozark cavefish, or any state endangered or rare species.

RESEARCH AND MONITORING

No species specific monitoring is being conducted concerning Cambarus hubrichti. The Cave Research Foundation is conducting bioinventory of caves of the Mark Twain National Forest and additional localities or other information on this species may be obtained.

RECOMMENDATIONS

Retain on list of Regional Forester Sensitive Species.

REFERENCES

Elliott, William R. 1998. Conservation of the North American cave and karst biota. Subterranean Biota (Ecosystems of the World). Elsevier Science. Electronic preprint at www.utexas.edu/depts/tnhc/.www/biospeleology/preprint.htm. 29 pages.

Gardner, J.E. 1986. Invertebrate fauna from Missouri caves and springs. Missouri Depatment of Conservation, Natural History Series 3, 72 pages.

Harvey, S.J. and J. Skeleton. 1968. Hydrogeologic study of a waste-disposal problem in a karst area at Springfield, Missouri. U.S. Geological Survey Professional Paper 600-C: C217-C220.

Hobbs Jr., H.H. 1952. A new albinistic crayfish of the genus Cambarus from southern Missouri with a key to the albinistic species of the genus (Decapoda, Astacidae). American Midland Naturalist, 48 (3): 689-693.

Hobbs, Jr., H.H., Hobbs III, H.H., and M.A. Daniel. 1977. A review of the troglobitic decapod crustaceans of the Americas. Smithsonian Contributions to Zoology, 244: 1-183.

Keith, J.H. 1988. Distribution of Northern cavefish, Amblyopsis spelaea DeKay, in Indiana and Kentucky and recommendations for its protection. Natural Areas Journal, 8 (2): 69-79.

Keith, J.H. and T.L. Poulson. 1981. Broken-back syndrome in Amblyopsis spelaea, Donaldson-Twin Caves, Indiana. Cave Research Foundation 1979 Annual Report, 45-48.

Lewis, Julian J. 1993. Life returns to Hidden River Cave: The rebirth of a destroyed cave system. National Speleological Society News, (June) 208-213.

Lewis, Julian J. 1996. The devastation and recovery of caves affected by industrialization. Proceedings of the 1995 National Cave Management Symposium, October 25-28, 1995, Spring Mill State Park, Indiana: 214-227.

Marquart, D. 1979. Troglobitic crayfish of Missouri. Master's Thesis, Central Missouri State University, Warrensburg, 39 pages.

Panno, S. V., I.G. Krapac, C.P. Weibel and J.D. Bade. 1996. Groundwater contamination in karst terrain of southwestern Illinois. Illinois Environmental Geology Series EG 151, Illinois State Geological Survey, 43 pages.

Panno, S.V., C.P. Weibel, I.G. Krapac and E.C. Storment. 1997. Bacterial contamination of groundwater from private septic systems in Illinois' sinkhole plain: regulatory considerations. Pages 443-447 In B.F. Beck and J.B. Stephenson (eds.). The engineering geology and hydrology of karst terranes. Proceedings of the sixth multidisciplinary conference on sinkholes and the engineering and environmental impacts on karst. Spring, Missouri.

Panno., S.V., W.R. Kelly, C.P. Weibel, I.G. Krapac, and S.L. Sargent. 1998. The effects of land use on water quality and agrichemical loading in the Fogelpole Cave groundwater basin, southwestern Illinois. Proceedings of the Illinois Groundwater Consortium Eighth Annual Conference, Research on agriculture chemicals in Illinois groundwater, 215-233.

Peck, Stewart B. 1969. Spent carbide – a poison to cave fauna. NSS Bulletin, 31(2): 53-54.

Pflieger, William L. 1996. The crayfishes of Missouri. Missouri Department of Conservation, 152 pages.

Quinlan, J.F. and D.R. Rowe. 1977. Hydrology and water quality in the central Kentucky karst. University of Kentucky Water Resources Research Institute, Research Report 101, 93 pages.

Quinlan, J.F. and D.R. Rowe. 1978. Hydrology and water quality in the central Kentucky karst: Phase II, Part A. Preliminary summary of the hydrogeology of the Mill Hole sub-basin of the Turnhole Spring groundwater basin. University of Kentucky Water Resources Research Institute, Research Report 109, 42 pages.

Sutton, Michael R. 1993. Caves and cave wildlife in a mineral prospecting area, Oregon and Shannon counties, Missouri. Missouri Speleology, 33 (1-4): 138 pages.

Sutton, Michael R. In press. Geography and biology of caves on the Mark Twain National Forest Doniphan-Eleven Point District, Missouri: Phase 2. Missouri Speleology.